# PATENT ABSTRACTS OF JAPAN

(11)Publication number : **09-321434**

(43)Date of publication of application : **12.12.1997**

(51)Int.Cl. **H05K 3/46**
**H05K 3/42**
**H05K 3/42**

(21)Application number : **08-135172**

(22)Date of filing : **29.05.1996**

(71)Applicant : **KYOCERA CORP**

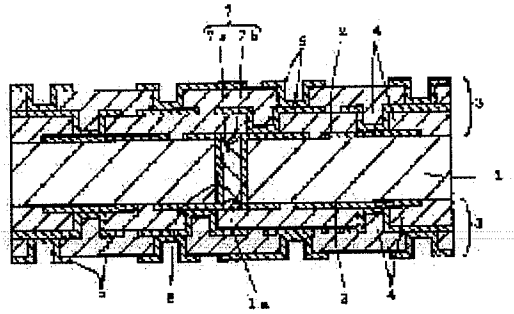
(72)Inventor : **NAKAI HIROKAZU**

## (54) WIRING BOARD AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To eliminate defect such as disconnection and short-circuiting caused by a difference of height between a through hole filler and a wiring conductor film in a thin film wiring conductor of a multilayer wiring part formed on a main surface of a wiring board.

SOLUTION: A wiring board consists of an insulation board 1 with a throughhole 1a passing through both upper and lower main surfaces, a wiring conductor film 2 formed in at least one main surface of the insulation board 1, a throughhole conductor film 6 which is formed in an inner wall of the through hole 1a and is electrically connected to the wiring conductor film 2, a throughhole filler 7 put inside the through hole 1a and a multilayer wiring part 3 which is formed in at least one main surface wherein the wiring conductor film 2 of the insulation board 1 is formed and formed by laminating an organic insulation film 4 and a thin film wiring conductor 5 alternately. As for the throughhole filler 7, a central region in a thickness direction of the throughhole 1a consists of a resin material 7a and a region near an opening consists of a metallic material 7b, and one surface of the throughhole filler 7 is positioned in the practically same plane as the wiring conductor film 2.



# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-321434
(43)Date of publication of application : 12.12.1997

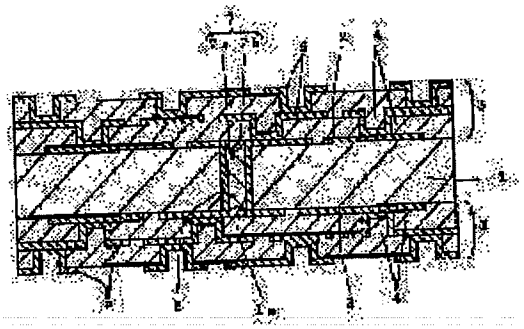
(51)Int.Cl. H05K 3/46
H05K 3/42
H05K 3/42

(21)Application number : 08-135172
(22)Date of filing : 29.05.1996

(71)Applicant : KYOCERA CORP
(72)Inventor : NAKAI HIROKAZU

## (54) WIRING BOARD AND ITS MANUFACTURE

(57)Abstract:
PROBLEM TO BE SOLVED: To eliminate defect such as disconnection and short-circuiting caused by a difference of height between a through hole filler and a wiring conductor film in a thin film wiring conductor of a multilayer wiring part formed on a main surface of a wiring board.



SOLUTION: A wiring board consists of an insulation board 1 with a throughhole 1a passing through both upper and lower main surfaces, a wiring conductor film 2 formed in at least one main surface of the insulation board 1, a throughhole conductor film 6 which is formed in an inner wall of the through hole 1a and is electrically connected to the wiring conductor film 2, a throughhole filler 7 put inside the through hole 1a and a multilayer wiring part 3 which is formed in at least one main surface wherein the wiring conductor film 2 of the insulation board 1 is formed and formed by laminating an organic insulation film 4 and a thin film wiring conductor 5 alternately. As for the throughhole filler 7, a central region in a thickness direction of the throughhole 1a consists of a resin material 7a and a region near an opening consists of a metallic material 7b, and one surface of the throughhole filler 7 is positioned in the practically same plane as the wiring conductor film 2.

## CLAIMS

[Claim(s)]
[Claim 1]A wiring board which a central area of a thickness direction of a through hole of ** and said through hole packing characterized by comprising the following is a resin material, and is characterized by a region near the opening comprising a metallic material, and locating the whole surface of said through hole packing in the same flat surface substantially with a wiring conductor film.
An insulating substrate which has a through hole penetrated to up-and-down both principal planes.
A wiring conductor film formed in the at least 1 principal surface of said insulating substrate, and a through hole conductor film which was fabricated by through hole wall and was electrically connected to said wiring conductor film, A multilevel interconnection part which is formed in the at least 1 principal surface in which through hole packing with which it filled up in said through hole, and said wiring conductor film of said insulating substrate are formed, and laminates an organic compound insulator and a thin film wiring conductor by turns.

[Claim 2]A manufacturing method of a wiring board characterized by comprising the following.
A process for which a plate-like insulating substrate is prepared.
A process of punching a through hole penetrated to said insulating substrate at up-and-down both principal planes of this insulating substrate.
A process of forming a wiring conductor film and a through hole conductor film, and a becoming conductor film in the at least 1 principal surface and a through hole wall of said insulating substrate.
A process of filling up a central area of a thickness direction of said through hole with a resin material, and a process of filling up a region near the opening of said through hole with a metallic material so that a part may project from the at least 1 principal surface of said insulating substrate, A process which grinds a conductor film formed in the at least 1 principal surface of said insulating substrate, and a metallic material with which said through hole was made to fill up, and locates substantially this conductor film and the whole surface of through hole packing on the same flat surface, A process of laminating an organic compound insulator and a thin film wiring conductor by turns, and forming a multilevel interconnection part on the 1 principal surface of said insulating substrate.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This art is related with the wiring board which has more a through hole penetrated to the up-and-down both principal planes of an insulating substrate in details about a wiring board.
[0002]
[Description of the Prior Art]Recently, as for the wiring board used for this electronic device, in connection with the small densification of an electronic device, the small densification is required increasingly. The wiring conductor film which changes from electrical conducting materials, such as copper, to for example, up-and-down both principal planes as a wiring board for realizing such small densification to the up-and-down both principal planes of the insulating substrate which comprises electrical insulation materials by which covering formation was carried out, such as a glass epoxy resin and ceramics, an epoxy resin, polyimide resin, The double-sided multilayer interconnection board from which covering formation of the multilevel interconnection part which laminates by turns the organic compound insulator which comprises resin materials, such as a fluororesin, and the thin film wiring conductor which comprises metal, such as copper, to a multilayer is carried out and which it comprises has come to be used abundantly.
[0003]While the through hole which penetrates this double-sided multilayer interconnection board to an insulating substrate at the up-and-down both principal planes of this ********** is formed, the through hole conductor film which comprises electrical conducting materials, such as copper, in this through hole is laminated.
The wiring conductor films allocated in the up-and-down both principal planes of an insulating substrate are electrically connected via the through hole conductor film by connecting the wiring conductor film by which covering formation was carried out to the up-and-down both principal planes of this through hole conductor film and an insulating substrate.

[0004]In order to form the thin film wiring conductor formed in this double-sided multilayer interconnection board on the organic compound insulator formed in the up-and-down both principal planes of an insulating substrate, and this organic compound insulator easily and with high density, It filled up with the inside of a through hole with through hole packing which comprises heat-curing resin, such as an epoxy resin, and the multilevel interconnection part could be formed easily and correctly also on the through hole by this in the insulating-substrate up-and-down principal surface, wiring density was not spoiled, and it has come.
[0005]Said double-sided multilayer interconnection board conventionally the through hole first penetrated to an insulating substrate at the up-and-down both principal planes of this insulating substrate The well-known drill method and the punching method, adopting conductor film forming technique, such as a method of plating well-known, as the up-and-down both principal planes and the through hole wall of this insulating substrate conventionally, and predetermined thickness being made to laminate a wiring conductor film and a through hole conductor film, and the becoming conductor film on them, while punching by adopting punching art, such as the laser method, and, By making this heat-harden at the temperature of about 150 **, while being filled

up with the precursor paste used as heat-curing resin, such as an epoxy resin, in the through hole of said insulating substrate, fill up the inside of a through hole with through hole packing which comprises heat-curing resin, such as an epoxy resin, and with it Next, after an appropriate time, While carrying out etching removal of some conductor films made to laminate on the up-and-down both principal planes of said insulating substrate to a prescribed pattern selectively by the well-known photolitho Griffey method conventionally and forming a wiring conductor film. It is manufactured by carrying out covering formation of an organic compound insulator and the thin film wiring conductor to predetermined thickness and a prescribed pattern one by one conventionally at the up-and-down both principal planes of the insulating substrate in which the wiring conductor film was formed by the thin film conductor forming methods, such as organic-compound-insulator molding methods, such as a well-known coating method, and plating.

[0006]

[Problem(s) to be Solved by the Invention]However, according to this conventional wiring board. The precursor paste with which it was filled up in the through hole when heating this and making it heat-harden, while being filled up with the precursor paste used as heat-curing resin, such as an epoxy resin, in the through hole of an insulating substrate once increases the mobility with heating, and flows out of the inside of a through hole, or, It is easy to become that in which the volume decreased at the time of hardening, and the upper and lower sides of packing were dented from the insulating-substrate upper and lower sides, As a result, a big level difference is formed between the packing surface and the conductor film surface in insulating-substrate up-and-down both principal planes, When forming in the up-and-down both principal planes of an insulating base the multilevel interconnection part which laminates an organic compound insulator and a thin film wiring conductor by turns, a thin film wiring conductor could not be formed correctly, but it had a fault of being easy to make a wiring conductor film generate defects, such as an open circuit and a short circuit.

[0007]

[Means for Solving the Problem]An insulating substrate which has a through hole which penetrates a wiring board of this invention to up-and-down both principal planes, A wiring conductor film formed in the at least 1 principal surface of said insulating substrate, and a through hole conductor film which was fabricated by through hole wall and was electrically connected to said wiring conductor film, Through hole packing with which it filled up in said through hole, and a multilevel interconnection part which is formed in the at least 1 principal surface in which said wiring conductor film of said insulating substrate is formed, and laminates an organic compound insulator and a thin film wiring conductor by turns, Are ********** and said through hole packing, In a central area of a thickness direction of a through hole, with a resin material, a region near the opening comprises a metallic material, And the whole surface of said through hole packing is the thing by which being substantially located in the same flat surface with a wiring conductor film, Since a region near the opening consists of a metallic material to ** and the whole surface of said through hole packing is substantially located in the same flat surface with a wiring conductor film while a central area of a thickness direction of a through hole comprises a resin material in said through hole packing, It does not have defects which originate in a level difference of through hole packing and a wiring conductor film, and are generated in a thin film wiring conductor of a multilevel interconnection part formed on the 1 principal surface of said wiring board, such as an open circuit and a short circuit.

[0008]A process which a manufacturing method of a wiring board of this invention prepares a plate-like insulating substrate, A process of punching a through hole penetrated to said insulating substrate at up-and-down both principal planes of this insulating substrate, A process which makes a wiring conductor film and a through hole conductor film, and a becoming conductor film laminate on the at least 1 principal surface and a through hole wall of said insulating substrate, A process of filling up a central area of a thickness direction of said through hole with a resin material, and a process of filling up a region near the opening of said through hole with a metallic material so that a part may project from the at least 1 principal surface of said insulating substrate, A process which grinds the conductor film surface formed in the at least 1 principal surface of said insulating substrate, and a metallic material with which said

through hole was made to fill up, and locates substantially a conductor wire film and the whole surface of through hole packing on the same flat surface, A process of laminating an organic compound insulator and a thin film wiring conductor by turns, and forming a multilevel interconnection part on the 1 principal surface of said insulating substrate, ****** -- it being characterized by things, a region near the opening of a through hole being filled up with a metallic material so that a part may project from the at least 1 principal surface of an insulating substrate while filling up a through hole central area with a resin material, and, Grind a conductor film formed in the at least 1 principal surface of an insulating substrate, and a metallic material with which said through hole was filled up, and this conductor film and the whole surface of through hole packing are substantially located on the same flat surface, Since an organic compound insulator and a thin film wiring conductor are laminated by turns and a multilevel interconnection part is formed on the 1 principal surface of this insulating substrate, a thin film wiring conductor of said multilevel interconnection part can be formed correctly.

[0009]

[Embodiment of the Invention]Next, this invention is explained in detail based on an attached drawing.

[0010]Drawing 1 is a sectional view for which one embodiment of the wiring board of this invention is shown, and, as for one, a wiring conductor film and 3 are multilevel interconnection parts an insulating substrate and 2 among a figure.

[0011]The insulating substrate 1 A glass epoxy resin, a bismaleimide resin, polyimide resin, Resin, such as thermosetting polyphenylene ether resin and fluorine system resin, or the nature sintered compact of an aluminum oxide, It acts as a support member for [ which comprises ceramics, such as a nature sintered compact of alumimium nitride, a nature sintered compact of mullite, a nature sintered compact of silicon carbide, and glass ceramics, and has up-and-down both principal planes ] it being monotonous and supporting the wiring conductor film 2 and the multilevel interconnection part 3 to the up-and-down both principal planes.

[0012]To the up-and-down both principal planes of said insulating substrate 1, the wiring conductor film 2 which comprises conductors, such as copper, is formed, and this wiring conductor film 2 succeeds in the operation which forms predetermined circuit wiring in a wiring board with the thin film wiring conductor 5 of the multilevel interconnection part 3 mentioned later.

[0013]The multilevel interconnection part 3 which laminates the organic compound insulator 4 and the thin film wiring conductor 5 by turns at a multilayer is formed in the up-and-down both principal planes at said insulating substrate 1, Electronic devices, such as a semiconductor device, a resistance element, a capacitative element, are electrically connected to the thin film wiring conductor 5 of this multilevel interconnection part 3 via the electrical connecting means of a bonding wire, a solder bump, etc.

[0014]The organic compound insulator 4 of said multilevel interconnection part 3 An epoxy resin and a bismaleimide resin, Resin, such as polyimide resin, thermosetting polyphenylene ether resin, and a fluororesin, is comprised, and it succeeds in the operation which insulates electrically the wiring conductor film 2, the thin film wiring conductor 5, and thin film wiring conductor 5 comrades at the same time it acts as a base material which supports the thin film wiring conductor 5.

[0015]The thin film wiring conductor 5 of the multilevel interconnection part 3 formed in the up-and-down both principal planes of said insulating substrate 1, the electronic device which is a conductor film which comprises electrical conducting materials, such as copper, is formed in the up-and-down both principal planes of the insulating substrate 1 via the organic compound insulator 4 at the prescribed pattern, and is carried in a wiring board -- mutual -- or it succeeds in the operation electrically connected outside.

[0016]In the wiring board of this invention, since the multilevel interconnection part 3 which laminates the organic compound insulator 4 and the thin film wiring conductor 5 by turns is formed in the up-and-down both principal planes of the insulating substrate 1, the small densification of a wiring board is realizable.

[0017]Two or more through holes 1a penetrated to up-and-down both principal planes are

punched at the position, and this through hole 1a acts on said insulating substrate 1 as a passage for electrically connecting mutually wiring conductor film 2 comrades formed in the up-and-down both principal planes of the insulating substrate 1.
[0018]The through hole conductor film 6 which comprises conductive materials, such as copper, is laminated on the through hole 1a wall of said insulating base 1, Wiring conductor film 2 comrades formed in the up-and-down both principal planes of the insulating substrate 1 are electrically mutually connected via the through hole conductor film 6 by connecting this through hole conductor film 6 and the wiring conductor film 2 made to laminate on insulating-substrate 1 up-and-down both principal planes.
[0019]It fills up with the through hole packing 7 in which the region near the through hole 1a opening comprises the metallic materials 7b, such as copper, while the central area of the thickness comprises the resin materials 7a, such as an epoxy resin, in the through hole 1a of said insulating substrate 1, By taking up the through hole 1a, also on the through hole 1a, this through hole packing 7 succeeds in the operation whose formation of the multilevel interconnection part 3 is enabled, and, thereby, makes further small densification of the wiring board possible.
[0020]Polish flattening of the surface of said through hole packing 7 and the surface of the wiring conductor film 2 laminated on the up-and-down both principal planes of the insulating substrate 1 is carried out so that it may be substantially located on the same flat surface.
[0021]The surface of said through hole packing 7, and the surface of the wiring conductor film 2 formed in the up-and-down both principal planes of the insulating substrate 1, From polish flattening being carried out so that it may be substantially located on the same flat surface. It does not have the defects in which the thin film wiring conductor 5 of the multilevel interconnection part 3 formed in the up-and-down both principal planes of the insulating base 1 is formed correctly, therefore the thin film wiring conductor 5 is formed by originating in the level difference of the through hole packing 7 and the wiring conductor film 2 of insulating-substrate 1 up-and-down both principal planes, such as an open circuit and a short circuit.
[0022]Said through hole packing 7 from the region near the opening of the through hole 1a comprising metallic materials, such as copper, as well as the wiring conductor 2. When carrying out polish flattening of the through hole packing 7 and the wiring conductor film 2 made to laminate on the up-and-down both principal planes of the insulating substrate 1, Polish flattening of the through hole packing 7 and the wiring conductor film 2 can be carried out easily and uniformly, and an unnecessary level difference is not formed between the through hole packing 7 and the wiring conductor film 2 of insulating base 1 up-and-down both principal planes.
[0023]Next, the manufacturing method of the wiring board of this invention is explained. First, as shown in drawing 2 (a), while preparing the plate-like insulating substrate 1, required-number punching of the through hole 1a penetrated to the prescribed position of this insulating substrate 1 at the up-and-down both principal planes of this insulating substrate 1 is carried out. When it comprises a glass epoxy resin, for example, said insulating substrate 1 is manufactured by making this heat-harden at the temperature of about 150 ** while impregnating with the precursor paste which contains an epoxy resin precursor and a hardening agent in the sheet which knit glass fiber and was full.
[0024]The punching art which uses a drill, laser, etc. for punching the through hole 1a penetrated to the prescribed position of said insulating substrate 1 at the up-and-down both principal planes of this insulating substrate 1 may be adopted suitably.
[0025]When a drill punches the through hole 1a at said insulating substrate 1, from it being easy to weld some scraps by friction with the drill and the insulating substrate 1 at the time of punching of the through hole 1a. It is preferred to carry out pure removal of the scraps which punched with the drill, and and welded the through hole 1a with detergent solutions, such as for example, a potassium permanganate solution. [ the scraps ]
[0026]Next, a well-known nonelectrolytic plating method and the electrolysis plating method are conventionally adopted as the up-and-down both principal planes of said insulating substrate 1, and a through hole 1a wall, and the wiring conductor film 2 and the through hole conductor film 5, and the becoming conductor film 10 are made to laminate, as shown in drawing 2 (b).

[0027]At this time, the conductor film 10 used as the wiring conductor film 2 made to laminate on the up-and-down both principal planes of said insulating base 1 is formed in a thickness of 35-45 micrometers thicker about 20-25 micrometers than 15-20 micrometers required as the wiring conductor film 2 in thickness. Since the thickness of the conductor film 10 decreased by about 20-25 micrometers when this carried out polish flattening of the metallic material 7b with which you make it filled up in the through hole 1a in the process mentioned later, and the conductor film 10 made to laminate on the insulating-substrate 1 upper and lower sides, after the conductor film 10 was ground, It is for securing 15-20 micrometers required as the wiring conductor film 2 in thickness.
[0028]Next, as shown in drawing 2 (c), the central area of the thickness direction of the through hole 1a of said insulating substrate 1 is filled up with the resin materials 7a, such as an epoxy resin.
[0029]In order to fill up the central area of the thickness direction of said through hole 1a with the resin material 7a, When the resin material 7a comprises an epoxy resin, for example, a bisphenol A type epoxy resin, An epoxy resin and amine system hardening agents, such as novolak type epoxy resin and glycidyl ester typed epoxy resin, While pouring in the paste which carries out addition mixing of the hardening agents, such as an imidazole series hardening agent and an acid anhydride system hardening agent, etc. into the through hole 1a, the method of making this paste heat-harden at the temperature of about 150 ** may be adopted suitably. In this case, when making this paste heat-harden, that volume decreases, those upper and lower sides are dented from the upper and lower sides of the insulating substrate 1, and, as a result, the paste poured in into the through hole 1a can fill up the center region of the through hole 1a with the resin 7a easily. Next, as shown in drawing 2 (d), as these some metallic materials 7b project in the region near the opening of said through hole 1a, it fills it up with the metallic materials 7b, such as copper, from the insulating-substrate 1 upper and lower sides.
[0030]As these some metallic materials 7b project [ metallic materials /, such as copper, / 7b ] in the region near the opening of said through hole 1a, in order to fill it up from the insulating-substrate 1 upper and lower sides, The method on which adopt a well-known electroless deposition method and electrolytic plating method as conventionally, and predetermined thickness is made to laminate metal, such as copper, may be suitably adopted as the resin material 7a surface with which the through hole 1a was filled up. Since the central area of the through hole 1a is beforehand filled up with the resin material 7a at this time, the unnecessary opening which could fill up easily the region near the opening of the through hole 1a with the metallic material 7b with plating etc. and where the plating solution etc. were enclosed with the through hole 1a central area is not formed.
[0031]When making the region near the opening of said through hole 1a laminate the metallic materials 7b, such as copper, with plating, if a resin material 7a surface top and its neighborhood are made to laminate the metallic material 7b selectively by plating by covering except the resin material 7a surface and its neighborhood with a masking material -- other portions -- an unnecessary plating film can be prevented from being laminated.
[0032]Next, as shown in drawing 2 (e), polish flattening of the conductor film 10 and the metallic material 7b which were formed in the both principal planes of the insulating substrate 1 is carried out so that the surface of this conductor film 10 and the surface of the metallic material 7b may be substantially located on the same flat surface.
[0033]At this time, since said metal 7b comprises metal, such as the same copper as the conductor film 10, the metal 7b and the conductor film 10 Ease, And polish flattening is carried out uniformly, and, as a result, a level difference is not formed between the packing 6 surface and the conductor film 10 surface, therefore the multilevel interconnection part 3 can be correctly formed in said insulating base 1 up-and-down both principal planes.
[0034]In order to carry out polish flattening of the surface of said metal 7b, and the surface of the conductor film 10, grinding method, such as well-known buffing, may be adopted conventionally.
[0035]Next, the wiring conductor film 2 is formed by adopting well-known photolithography technology conventionally and etching into a prescribed pattern the conductor film 10 made to

laminate on the up-and-down both principal planes of the insulating substrate 1.
[0036]Next, as some wiring conductor films 2 are exposed to the up-and-down both principal planes of the insulating substrate 1 in which said wiring conductor film 2 was formed, while carrying out covering formation of the organic compound insulator 4 of a first pass eye, on this the thin film wiring conductor 5, By carrying out laminating formation of the organic compound insulator 4 and the thin film wiring conductor 5 of a next layer one by one if needed on it, the multilevel interconnection part 3 is formed and the wiring board of this invention shown in drawing 1 by this is completed.
[0037]The both principal planes of the insulating substrate 1 in which said multilevel interconnection part 3 is formed in this case, Since polish flattening is carried out so that the wiring conductor film 2 and the through hole packing 7 may be substantially located on the same side, the multilevel interconnection part 3 can be formed very correctly on these both principal planes, and the thin film wiring conductor 5 of the multilevel interconnection part 3 is not made to generate defects, such as an open circuit and a short circuit.
[0038]When it comprises an epoxy resin, said organic compound insulator 4, for example Phenol novolak resin, Adopt paste coating methods, such as a well-known spin coat method and the curtain coat method, conventionally, and the photosensitive precursor paste used as the epoxy resin containing methylolmelamine, diaryldiazonium salt, and propylene-glycol-monomethyl-ether acetate is applied to a thickness of 30-60 micrometers, After drying this, while adopting the photolithography technology of the conventional common knowledge and performing perforation processing to a prescribed position, it is formed by impressing the temperature of about 150 ** and making it heat-harden. The thin film wiring conductor 5 formed on said organic compound insulator 4, While adopting a well-known nonelectrolytic plating method and the electrolysis plating method conventionally and making a thickness of 15-20 micrometers laminate the thin film conductor film which changes from copper to the wiring conductor film 2 upper surface exposed from the hole formed in the organic compound insulator 4 and the organic compound insulator 4. It is formed by adopting well-known photolithography technology conventionally and etching into a prescribed pattern the thin film conductor film which comprises this copper.
[0039]According to the manufacturing method of the wiring board of this invention, the double-sided multilayer interconnection board by which the multilevel interconnection part 3 was formed also on the through hole 1a is manufactured in this way.
[0040]A wiring board of this invention and a manufacturing method for the same are not what is limited to an above-mentioned example, To the resin material 7a which is possible for various change and they has if it is a range which does not deviate from the gist of this invention, for example, constitutes said through hole packing 7, if needed Glass and silica, The filler which may make as [ make / the filler which comprises inorganic insulators and metal, such as alumina, resin, etc. / contain ], and also changes from glass, silica, alumina, etc. to said organic compound insulator 4 may be made to contain.
[0041]
[Effect of the Invention]According to the wiring board of this invention, through hole packing, Since the region near the opening consists of a metallic material to ** and the whole surface of said through hole packing is substantially located in the same flat surface with the wiring conductor film while the central area of the thickness direction of a through hole comprises a resin material, It does not have defects which originate in the level difference of through hole packing and a wiring conductor film, and are generated in the thin film wiring conductor of the multilevel interconnection part formed on the 1 principal surface of said wiring board, such as an open circuit and a short circuit.
[0042]According to the manufacturing method of the wiring board of this invention, while filling up a through hole central area with a resin material, the region near the opening of a through hole is filled up with a metallic material so that a part may project from the at least 1 principal surface of an insulating substrate, Grind the conductor film formed in the at least 1 principal surface of an insulating substrate, and the metallic material with which said through hole was filled up, and a wiring conductor film and the whole surface of through hole packing are substantially located on the same flat surface, Since an organic compound insulator and a thin

film wiring conductor are laminated by turns and a multilevel interconnection part is formed on the 1 principal surface of this insulating substrate, the thin film wiring conductor of said multilevel interconnection part can be formed correctly.

---

[Translation done.]

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a sectional view showing one embodiment of the wiring board of this invention.
[Drawing 2](a) – (e) is a sectional view for every process for explaining the manufacturing method of the wiring board of this invention.
[Description of Notations]
1 ..... Insulating substrate
1a ..... Through hole
2 ..... Wiring conductor film
3 ..... Multilevel interconnection part
4 ..... Organic compound insulator
5 ..... Thin film wiring conductor
6 ..... Through hole conductor film
7 ..... Through hole packing
7a ..... Resin material
7b ..... Metallic material

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号

特開平9－321434

(43)公開日　平成９年(1997)12月12日

| (51)Int.Cl.[6] | | 識別記号 | 庁内整理番号 | ＦＩ | | | 技術表示箇所 |
|---|---|---|---|---|---|---|---|
| Ｈ０５Ｋ | 3/46 | | | Ｈ０５Ｋ | 3/46 | Ｎ | |
| | | | | | | Ｅ | |
| | 3/42 | ６２０ | 7128－4Ｅ | | 3/42 | ６２０Ｚ | |
| | | ６５０ | 7128－4Ｅ | | | ６５０Ｃ | |

審査請求　未請求　請求項の数２　ＯＬ　（全 ６ 頁）

(21)出願番号　特願平8－135172

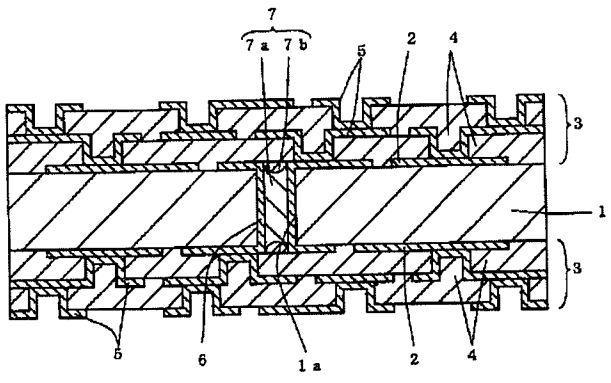
(22)出願日　平成８年(1996)５月29日

(71)出願人　000006633
京セラ株式会社
京都府京都市山科区東野北井ノ上町５番地の22

(72)発明者　仲井　宏和
鹿児島県国分市山下町１番１号　京セラ株式会社鹿児島国分工場内

(54)【発明の名称】　配線基板及びその製造方法

(57)【要約】
【課題】多層配線部の薄膜配線導体に断線や短絡等の欠陥を発生させやすい。
【解決手段】上下両主面に貫通するスルーホール１ａを有する絶縁基板１と、前記絶縁基板１の少なくとも一主面に形成された配線導体膜２と、スルーホール１ａ内壁に成形され、前記配線導体膜２に電気的に接続されたスルーホール導体膜６と、前記スルーホール１ａ内に充填されたスルーホール充填物と７、前記絶縁基板１の前記配線導体膜２が形成されている少なくとも一主面に形成され、有機絶縁膜４と薄膜配線導体５とを交互に積層して成る多層配線部３と、から成る配線基板であって、前記スルーホール充填物７は、スルーホール１ａの厚み方向の中央域が樹脂材７ａで、開口近傍域が金属材７ｂから成り、且つ前記スルーホール充填物７の一面が配線導体膜２と実質的に同一平面に位置している。



【特許請求の範囲】
【請求項１】上下両主面に貫通するスルーホールを有する絶縁基板と、前記絶縁基板の少なくとも一主面に形成された配線導体膜と、スルーホール内壁に成形され、前記配線導体膜に電気的に接続されたスルーホール導体膜と、前記スルーホール内に充填されたスルーホール充填物と、前記絶縁基板の前記配線導体膜が形成されている少なくとも一主面に形成され、有機絶縁膜と薄膜配線導体とを交互に積層して成る多層配線部と、から成る配線基板であって、前記スルーホール充填物は、スルーホールの厚み方向の中央域が樹脂材で、開口近傍域が金属材から成り、且つ前記スルーホール充填物の一面が配線導体膜と実質的に同一平面に位置していることを特徴とする配線基板。
【請求項２】平板状の絶縁基板を準備する工程と、前記絶縁基板に該絶縁基板の上下両主面に貫通するスルーホールを穿孔する工程と、前記絶縁基板の少なくとも一主面及びスルーホール内壁に配線導体膜及びスルーホール導体膜となる導体膜を形成する工程と、前記スルーホールの厚み方向の中央域に樹脂材を充填する工程と、前記スルーホールの開口近傍域に金属材を一部が前記絶縁基板の少なくとも一主面から突出するように充填する工程と、前記絶縁基板の少なくとも一主面に形成された導体膜と前記スルーホールに充填させた金属材とを研磨し、該導体膜とスルーホール充填物の一面とを実質的に同一平面上に位置させる工程と、前記絶縁基板の一主面上に有機絶縁膜と薄膜配線導体とを交互に積層して多層配線部を形成する工程と、を含むことを特徴とする配線基板の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本技術は、配線基板に関し、より詳細には絶縁基板の上下両主面に貫通するスルーホールを有する配線基板に関するものである。
【０００２】
【従来の技術】近時、電子装置の小型高密度化に伴い、該電子装置に使用される配線基板もその小型高密度化が要求されるようになってきている。このような小型高密度化を実現するための配線基板として例えば、上下両主面に銅等の導電材料から成る配線導体膜が被着形成されたガラス－エポキシ樹脂やセラミックス等の電気絶縁材料から成る絶縁基板の上下両主面にエポキシ樹脂、ポリイミド樹脂、ふっ素樹脂等の樹脂材料から成る有機絶縁膜と銅等の金属から成る薄膜配線導体とを交互に多層に積層して成る多層配線部が被着形成されて成る両面多層配線基板が多用されるようになってきた。
【０００３】かかる両面多層配線基板は、絶縁基板に該絶縁基板をの上下両主面に貫通するスルーホールが形成されているとともに該スルーホール内に銅等の導電材料から成るスルーホール導体膜が被着されており、該スルーホール導体膜と絶縁基板の上下両主面に被着形成された配線導体膜とを接続することにより絶縁基板の上下両主面に配設された配線導体膜同士がスルーホール導体膜を介して電気的に接続されている。
【０００４】また、かかる両面多層配線基板では、絶縁基板の上下両主面に形成される有機絶縁膜及び該有機絶縁膜上に形成される薄膜配線導体を容易、且つ高密度に形成するために、スルーホール内がエポキシ樹脂等の熱硬化樹脂から成るスルーホール充填物により充填されており、これにより絶縁基板上下主面でスルーホール上にも多層配線部を容易、且つ正確に形成することができ、高密度配線が損なわれないようになっている。
【０００５】尚、前記両面多層配線基板は、先ず絶縁基板に該絶縁基板の上下両主面に貫通するスルーホールを従来周知のドリル法やパンチ法、レーザー法等の穿孔技術を採用することにより穿孔するとともに該絶縁基板の上下両主面及びスルーホール内壁に配線導体膜及びスルーホール導体膜となる導体膜を従来周知のめっき法等の導体膜成形技術を採用して所定の厚みに被着させ、次に前記絶縁基板のスルーホール内にエポキシ樹脂等の熱硬化樹脂となる前駆体ペーストを充填するとともにこれを約１５０℃の温度で熱硬化させることによりスルーホール内をエポキシ樹脂等の熱硬化樹脂から成るスルーホール充填物で充填し、しかる後、前記絶縁基板の上下両主面に被着させた導体膜の一部を従来周知のフォトリソグリフィー法により所定パターンに選択的にエッチング除去して配線導体膜を形成するとともに配線導体膜が形成された絶縁基板の上下両主面に有機絶縁膜及び薄膜配線導体を従来周知のコーティング法等の有機絶縁膜成形法及びメッキ法等の薄膜導体形成法により順次所定厚み、所定パターンに被着形成していくことによって製作される。
【０００６】
【発明が解決しようとする課題】しかしながら、この従来の配線基板によると、絶縁基板のスルーホール内にエポキシ樹脂等の熱硬化樹脂となる前駆体ペーストを充填するとともにこれを加熱して熱硬化させる際にスルーホール内に充填した前駆体ペーストが加熱により一旦その流動性を増大させてスルーホール内から流出したり、更に硬化時にその体積が減少して充填物の上下面が絶縁基板上下面から凹んだものとなり易く、その結果、絶縁基板上下両主面における充填物表面と導体膜表面との間に大きな段差が形成され、絶縁基体の上下両主面に有機絶縁膜と薄膜配線導体とを交互に積層して成る多層配線部を形成する際に薄膜配線導体を正確に形成することができず、配線導体膜に断線や短絡等の欠陥を発生させやすいという欠点を有していた。
【０００７】
【課題を解決するための手段】本発明の配線基板は、上下両主面に貫通するスルーホールを有する絶縁基板と、

前記絶縁基板の少なくとも一主面に形成された配線導体膜と、スルーホール内壁に成形され、前記配線導体膜に電気的に接続されたスルーホール導体膜と、前記スルーホール内に充填されたスルーホール充填物と、前記絶縁基板の前記配線導体膜が形成されている少なくとも一主面に形成され、有機絶縁膜と薄膜配線導体とを交互に積層して成る多層配線部と、から成る配線基板であって、前記スルーホール充填物は、スルーホールの厚み方向の中央域が樹脂材で、開口近傍域が金属材から成り、且つ前記スルーホール充填物の一面が配線導体膜と実質的に同一平面に位置していることを特徴とするものであり、前記スルーホール充填物がスルーホールの厚み方向の中央域が樹脂材から成るとともに開口近傍域が金属材から成からなり、前記スルーホール充填物の一面が配線導体膜と実質的に同一平面に位置しているので、前記配線基板の一主面上に形成された多層配線部の薄膜配線導体にスルーホール充填物と配線導体膜との段差に起因して発生する断線や短絡等の欠陥を有することはない。

【０００８】また、本発明の配線基板の製造方法は、平板状の絶縁基板を準備する工程と、前記絶縁基板に該絶縁基板の上下両主面に貫通するスルーホールを穿孔する工程と、前記絶縁基板の少なくとも一主面及びスルーホール内壁に配線導体膜及びスルーホール導体膜となる導体膜を被着させる工程と、前記スルーホールの厚み方向の中央域に樹脂材を充填する工程と、前記スルーホールの開口近傍域に金属材を一部が前記絶縁基板の少なくとも一主面から突出するように充填する工程と、前記絶縁基板の少なくとも一主面に形成された導体膜表面と前記スルーホールに充填させた金属材とを研磨し、導体配線膜とスルーホール充填物の一面とを実質的に同一平面上に位置させる工程と、前記絶縁基板の一主面上に有機絶縁膜と薄膜配線導体とを交互に積層し、多層配線部を形成する工程と、を含むことを特徴とするものであり、スルーホール中央域に樹脂材を充填するとともにスルーホールの開口近傍域に金属材を一部が絶縁基板の少なくとも一主面から突出するように充填し、絶縁基板の少なくとも一主面に形成された導体膜と前記スルーホールに充填された金属材とを研磨して該導体膜とスルーホール充填物の一面とを実質的に同一平面上に位置させ、該絶縁基板の一主面上に有機絶縁膜と薄膜配線導体とを交互に積層して多層配線部を形成することから、前記多層配線部の薄膜配線導体を正確に形成することができる。

【０００９】

【発明の実施の形態】次に本発明を添付の図面を基に詳細に説明する。

【００１０】図１は、本発明の配線基板の一実施形態を示す断面図であり、図中、１は絶縁基板、２は配線導体膜、３は多層配線部である。

【００１１】絶縁基板１は、ガラス－エポキシ樹脂やビスマレイミド樹脂、ポリイミド樹脂、熱硬化性ポリフェニレンエーテル樹脂、ふっ素系樹脂等の樹脂、あるいは酸化アルミニウム質焼結体、窒化アルミニウム質焼結体、ムライト質焼結体、炭化珪素質焼結体、ガラス－セラミックス等のセラミックスから成り上下両主面を有する平板であり、その上下両主面に配線導体膜２及び多層配線部３を支持するための支持部材として作用する。

【００１２】前記絶縁基板１の上下両主面には例えば銅等の導体から成る配線導体膜２が形成されており、該配線導体膜２は、後述する多層配線部３の薄膜配線導体５とともに配線基板中で所定の回路配線を形成する作用を為す。

【００１３】また前記絶縁基板１には、その上下両主面に有機絶縁膜４及び薄膜配線導体５を交互に多層に積層してなる多層配線部３が形成されており、該多層配線部３の薄膜配線導体５には半導体素子や抵抗素子、容量素子等の電子素子がボンディングワイヤーや半田バンプ等の電気的接続手段を介して電気的に接続される。

【００１４】前記多層配線部３の有機絶縁膜４は、エポキシ樹脂やビスマレイミド樹脂、ポリイミド樹脂、熱硬化性ポリフェニレンエーテル樹脂、ふっ素樹脂等の樹脂から成り、薄膜配線導体５を支持する支持体として作用すると同時に配線導体膜２と薄膜配線導体５とを及び薄膜配線導体５同士を電気的に絶縁する作用を為す。

【００１５】また、前記絶縁基板１の上下両主面に形成された多層配線部３の薄膜配線導体５は、銅等の導電材料から成る導体膜であり、絶縁基板１の上下両主面に有機絶縁膜４を介して所定パターンに形成されており、配線基板に搭載される電子素子を相互にあるいは外部に電気的に接続する作用を為す。

【００１６】本発明の配線基板においては、絶縁基板１の上下両主面に有機絶縁膜４及び薄膜配線導体５を交互に積層して成る多層配線部３が形成されていることから、配線基板の小型高密度化が実現できる。

【００１７】また前記絶縁基板１には、上下両主面に貫通するスルーホール１ａが所定の位置に複数穿孔されており、該スルーホール１ａは絶縁基板１の上下両主面に形成された配線導体膜２同士を互いに電気的に接続するための通路として作用する。

【００１８】前記絶縁基体１のスルーホール１ａ内壁には銅等の導体材料から成るスルーホール導体膜６が被着されており、該スルーホール導体膜６と絶縁基板１上下両主面に被着させた配線導体膜２とが接続されることにより絶縁基板１の上下両主面に形成された配線導体膜２同士がスルーホール導体膜６を介して互いに電気的に接続されている。

【００１９】更に、前記絶縁基板１のスルーホール１ａ内にはその厚みの中央域がエポキシ樹脂等の樹脂材７ａから成るとともにスルーホール１ａ開口近傍域が銅等の金属材７ｂから成るスルーホール充填物７が充填されており、該スルーホール充填物７は、スルーホール１ａを

塞ぐことによりスルーホール１ａ上にも多層配線部３を形成可能とする作用を為し、これにより配線基板の更なる小型高密度化を可能としている。

【００２０】また、前記スルーホール充填物７の表面と絶縁基板１の上下両主面に被着された配線導体膜２の表面とは、実質的に同一平面上に位置するように研磨平坦化されている。

【００２１】前記スルーホール充填物７の表面と絶縁基板１の上下両主面に形成された配線導体膜２の表面とは、実質的に同一平面上に位置するように研磨平坦化されていることから、絶縁基体１の上下両主面に形成された多層配線部３の薄膜配線導体５が正確に形成され、従って薄膜配線導体５がスルーホール充填物７と絶縁基板１上下両主面の配線導体膜２との段差に起因して形成される断線や短絡等の欠陥を有することはない。

【００２２】尚、前記スルーホール充填物７は、スルーホール１ａの開口近傍域が配線導体２と同様に銅等の金属材から成ることから、スルーホール充填物７と絶縁基板１の上下両主面に被着させた配線導体膜２とを研磨平坦化する際に、スルーホール充填物７と配線導体膜２とを容易、且つ均一に研磨平坦化することができ、スルーホール充填物７と絶縁基体１上下両主面の配線導体膜２との間に不要な段差が形成されることはない。

【００２３】次に本発明の配線基板の製造方法について説明する。先ず、図２（ａ）に示すように、平板状の絶縁基板１を準備するとともに該絶縁基板１の所定位置に該絶縁基板１の上下両主面に貫通するスルーホール１ａを必要数穿孔する。　前記絶縁基板１は、例えばガラス－エポキシ樹脂から成る場合、ガラス繊維を編みこんだシートにエポキシ樹脂前駆体及び硬化剤を含む前駆体ペーストを含浸させるとともにこれを約１５０℃の温度で熱硬化させることによって製作される。

【００２４】また前記絶縁基板１の所定位置に該絶縁基板１の上下両主面に貫通するスルーホール１ａを穿孔するにはドリルやレーザー等を使用した穿孔技術が好適に採用され得る。

【００２５】尚、前記絶縁基板１にドリルでスルーホール１ａを穿孔した場合、穿孔時におけるドリルと絶縁基板１との摩擦によりスルーホール１ａの内壁に切り屑の一部が溶着しやすいことから、スルーホール１ａをドリルにより穿孔して場合、溶着した切り屑を例えば過マンガン酸カリウム溶液等の清浄液により清浄除去することが好ましい。

【００２６】次に図２（ｂ）に示すように、前記絶縁基板１の上下両主面及びスルーホール１ａ内壁に従来周知の無電解めっき法及び電解めっき法を採用して配線導体膜２及びスルーホール導体膜５となる導体膜１０を被着させる。

【００２７】尚、このとき、前記絶縁基体１の上下両主面に被着させた配線導体膜２となる導体膜１０は配線導体膜２として必要な厚み１５～２０μｍよりも２０～２５μｍ程度厚い３５～４５μｍの厚みに形成しておく。これは、後述する工程においてスルーホール１ａ内に充填させる金属材７ｂと絶縁基板１上下面に被着させた導体膜１０とを研磨平坦化する際に導体膜１０の厚みが２０～２５μｍ程度減少することから導体膜１０が研磨された後、配線導体膜２として必要な厚み１５～２０μｍを確保するためである。

【００２８】次に図２（ｃ）に示すように、前記絶縁基板１のスルーホール１ａの厚み方向の中央域にエポキシ樹脂等の樹脂材７ａを充填する。

【００２９】前記スルーホール１ａの厚み方向の中央域に樹脂材７ａを充填するには、例えば樹脂材７ａがエポキシ樹脂から成る場合、ビスフェノールＡ型エポキシ樹脂、ノボラック型エポキシ樹脂、グリシジルエステル型エポキシ樹脂等のエポキシ樹脂及びアミン系硬化剤、イミダゾール系硬化剤、酸無水物系硬化剤等の硬化剤等を添加混合してなるペーストをスルーホール１ａ内に注入するとともに該ペーストを約１５０℃の温度で熱硬化させる方法が好適に採用され得る。この場合、スルーホール１ａ内に注入したペーストは、該ペーストを熱硬化させる際にその体積が減少し、その上下面が絶縁基板１の上下面から凹んでしまい、その結果、スルーホール１ａの中央領域を樹脂７ａで容易に充填することができる。

次に図２（ｄ）に示すように、前記スルーホール１ａの開口近傍域に銅等の金属材７ｂを該金属材７ｂの一部が絶縁基板１上下面から突出するようにして充填する。

【００３０】前記スルーホール１ａの開口近傍域に銅等の金属材７ｂを該金属材７ｂの一部が絶縁基板１上下面から突出するようにして充填するには、スルーホール１ａに充填された樹脂材７ａ表面に銅等の金属を従来周知の無電解メッキ法及び電解メッキ法を採用して所定厚みに被着させる方法が好適に採用され得る。このとき、スルーホール１ａの中央域は予め樹脂材７ａで充填されているので、スルーホール１ａの開口近傍域に金属材７ｂをメッキ法等により容易に充填することができ、またスルーホール１ａ中央域に例えばメッキ液等が封入された不要な空隙が形成されることもない。

【００３１】尚、前記スルーホール１ａの開口近傍域に銅等の金属材７ｂをメッキ法により被着させる場合、樹脂材７ａ表面及びその近傍以外をマスキング材で覆ってメッキを行うことにより樹脂材７ａ表面上及びその近傍に金属材７ｂを選択的に被着させれば、他の部分不要なメッキ膜が被着されるのを防止できる。

【００３２】次に図２（ｅ）に示すように、絶縁基板１の両主面に形成された導体膜１０及び金属材７ｂを該導体膜１０の表面と金属材７ｂの表面とが実質的に同一平面上に位置するように研磨平坦化する。

【００３３】このとき前記金属７ｂは導体膜１０と同様の銅等の金属から成ることから金属７ｂと導体膜１０と

は容易、且つ均等に研磨平坦化され、その結果、充填物６表面と導体膜１０表面との間に段差が形成されることはなく、従って、前記絶縁基体１上下両主面に多層配線部３を正確に形成することができる。

【００３４】尚、前記金属７ｂの表面と導体膜１０の表面とを研磨平坦化するには、従来周知のバフ研磨法等の研磨法が採用され得る。

【００３５】次に絶縁基板１の上下両主面に被着させた導体膜１０を従来周知のフォトリソグラフィー技術を採用して所定パターンにエッチングすることにより配線導体膜２を形成する。

【００３６】次に前記配線導体膜２が形成された絶縁基板１の上下両主面に配線導体膜２の一部を露出させるようにして第一層目の有機絶縁膜４を被着形成するとともにこの上に薄膜配線導体５を、更にその上に次層の有機絶縁膜４及び薄膜配線導体５を必要に応じて順次積層形成していくことによって多層配線部３を形成し、これによって図１に示す本発明の配線基板が完成する。

【００３７】尚、この場合、前記多層配線部３が形成される絶縁基板１の両主面は、配線導体膜２とスルーホール充填物７とが実質的に同一面上に位置するように研磨平坦化されていることから該両主面上に多層配線部３を極めて正確に形成することができ、多層配線部３の薄膜配線導体５に断線やショート等の欠陥を発生させることはない。

【００３８】また、前記有機絶縁膜４は、エポキシ樹脂から成る場合、例えばフェノールノボラック樹脂、メチロールメラミン、ジアリルジアゾニウム塩及びプロピレングリコールモノメチルエーテルアセテートを含むエポキシ樹脂となる感光性の前駆体ペーストを従来周知のスピンコート法やカーテンコート法等のペースト塗布法を採用して３０～６０μｍの厚みに塗布し、これを乾燥後、従来周知のフォトリソグラフィー技術を採用して所定位置に孔あけ加工を施すとともに約１５０℃の温度を印加して熱硬化させることにより形成される。　また前記有機絶縁膜４の上に形成される薄膜配線導体５は、有機絶縁膜４及び有機絶縁膜４に形成された孔から露出する配線導体膜２上面に銅から成る薄膜導体膜を従来周知の無電解めっき法及び電解めっき法を採用して１５～２０μｍの厚みに被着させるとともに該銅から成る薄膜導体膜を従来周知のフォトリソグラフィー技術を採用して所定パターンにエッチングすることによって形成される。

【００３９】かくして本発明の配線基板の製造方法によれば、スルーホール１ａ上にも多層配線部３が形成された両面多層配線基板が製作される。

【００４０】尚、本発明の配線基板及びその製造方法は、上述の実施例に限定されるものではなく、本発明の要旨を逸脱しない範囲であれば種々の変更は可能で有り、例えば前記スルーホール充填物７を構成する樹脂材７ａには必要に応じてガラスやシリカ、アルミナ等の無機絶縁物や金属、樹脂等から成るフィラーを含有させるようになしてもよく、更には前記有機絶縁膜４にガラスやシリカ、アルミナ等から成るフィラーを含有させてもよい。

【００４１】

【発明の効果】本発明の配線基板によれば、スルーホール充填物は、スルーホールの厚み方向の中央域が樹脂材から成るとともに開口近傍域が金属材から成からなり、前記スルーホール充填物の一面が配線導体膜と実質的に同一平面に位置しているので、前記配線基板の一主面上に形成された多層配線部の薄膜配線導体にスルーホール充填物と配線導体膜との段差に起因して発生する断線や短絡等の欠陥を有することはない。

【００４２】また本発明の配線基板の製造方法によれば、スルーホール中央域に樹脂材を充填するとともにスルーホールの開口近傍域に金属材を一部が絶縁基板の少なくとも一主面から突出するように充填し、絶縁基板の少なくとも一主面に形成された導体膜と前記スルーホールに充填された金属材とを研磨して配線導体膜とスルーホール充填物の一面とを実質的に同一平面上に位置させ、該絶縁基板の一主面上に有機絶縁膜と薄膜配線導体とを交互に積層し、多層配線部を形成することから、前記多層配線部の薄膜配線導体を正確に形成することができる。

【図面の簡単な説明】

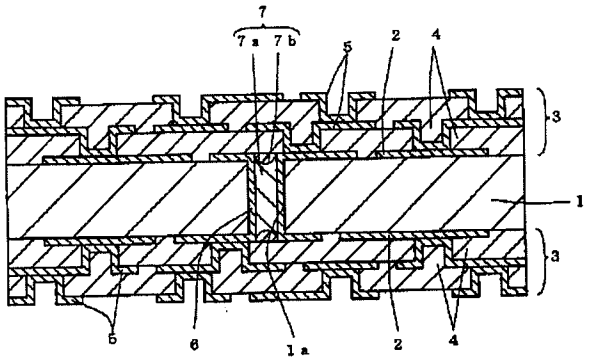
【図１】本発明の配線基板の一実施形態を示す断面図である。

【図２】（ａ）～（ｅ）は、本発明の配線基板の製造方法を説明するための工程毎の断面図である。

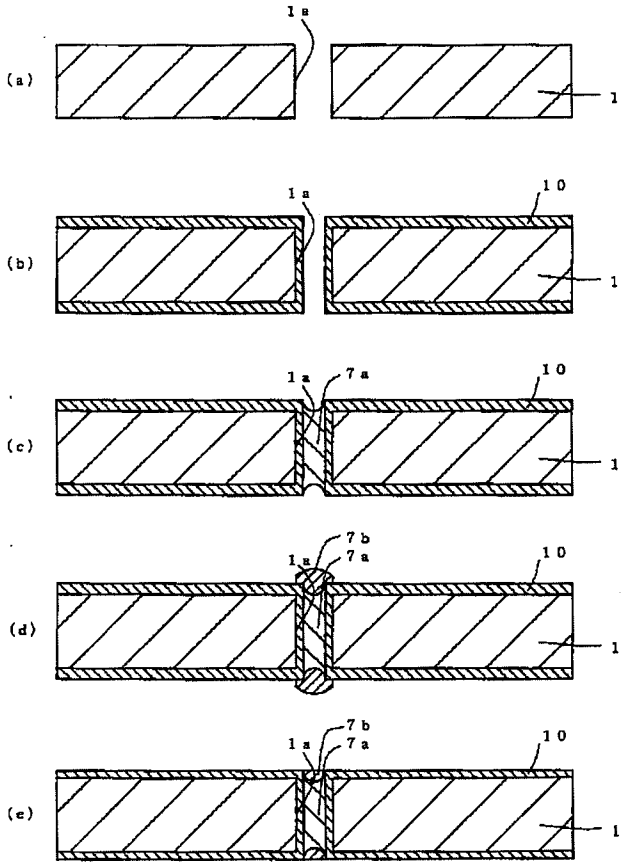
【符号の説明】

１・・・・・・絶縁基板
１ａ・・・・・スルーホール
２・・・・・・配線導体膜
３・・・・・・多層配線部
４・・・・・・有機絶縁膜
５・・・・・・薄膜配線導体
６・・・・・・スルーホール導体膜
７・・・・・・スルーホール充填物
７ａ・・・・・樹脂材
７ｂ・・・・・金属材

【図1】


7
7a
7b
5
2
4
3
1
3
5
6
1a
2
4

【図2】


(a)
1a
1
(b)
1a
10
1
(c)
1a
7a
10
1
(d)
7b
7a
1a
10
1
(e)
7b
7a
1a
10
1